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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/696,346	10/29/2003	Srikanth B. Samavedam	SC13102TP	8087
23125	7590	02/10/2005	EXAMINER	
FREESCALE SEMICONDUCTOR, INC. LAW DEPARTMENT 7700 WEST PARMER LANE MD:TX32/PL02 AUSTIN, TX 78729			CHAUDHARI, CHANDRA P	
			ART UNIT	PAPER NUMBER
			2829	

DATE MAILED: 02/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/696,346

Applicant(s)

SAMAVEDAM ET AL.

Examiner

Chandra Chaudhari

Art Unit

2829

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) 27 and 31 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26, 28-30, 32 and 33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |  |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10-29-03</u> | 6) <input type="checkbox"/> Other: ____  |

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-26, 28-30, 32-33, drawn to a method of making a semiconductor device, classified in class 438, subclass 216.
- II. Claims 27, 31, drawn to a semiconductor device, classified in class 257, subclass 412.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product as claimed can be made by another and materially different process such as using selective means instead of patterning.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

During a telephone conversation with Kim-Marie Vo on January 4, 2005 a provisional election was made without traverse to prosecute the invention of I, claims 1-26, 28-30, 32-33. Affirmation of this election must be made by applicant in replying to this Office action. Claims 27, 31 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim 30 is objected to because of the following informalities:

in line 2, "PrB" should be "PrB<sub>6</sub>".

Appropriate correction is required.

Applicant is advised that should claims 6, 25, and 26 be found allowable, claims 26, 30, and 29 respectively will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. Note that (claims 6 and 28), (claims 26 and 29), and (claims 25 and 30) are duplicates. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 6, 9-11, 13-16, 19, 22-24, 26, 28-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Matsuda – US 5,132,756.

Matsuda (Figs. 1a-1d and text in col. 2, line 50 to col. 3, line 51) discloses the claimed invention by forming gate dielectric 2, gate electrode material 6 comprising one of (boron and carbon) and nitrogen, current electrode regions 7-8, dielectric layer 10 over and in contact with the gate electrode.

Claims 1-3, 6, 9, 11-16, 22, 24-26, 29-30 are rejected under 35 U.S.C. 102(b) as being anticipated by Mikoshiba – US 5,245,207.

Mikoshiba (Fig.1 and text in col. 7, line 3 to col. 12, line 53) discloses the claimed invention by forming a gate electrode of one of boron and carbon, current electrodes 12, 25, and a dielectric layer 18.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda and Joo – US 5,965,911.

Matsuda is applied as above and does not disclose a target material and process gas or carbon and nitrogen. Joo (col. 3, lines 1+) teaches to form a gate electrode material with process gases of carbon (methane) and nitrogen.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use process gases as taught by Joo in Matsuda's process to accurately form the gate material.

Claims 1-6, 9-11, 13, 28, 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art and Joo – US 5,965,911.

Applicant's admitted prior art on pages 1-2 of the specification discloses substantially the claimed invention by forming a gate electrode material over a gate dielectric material which are patterned, and forming current electrodes (source/drain regions which may be doped either p or n type) laterally adjacent the gate dielectric. The admitted prior art does not disclose depositing the gate electrode material comprising a transition metal and elements consisting of (boron or carbon) and nitrogen. Joo (col. 3, lines 1+) teaches to form a gate electrode material of TiCN by reactive sputtering with process gases of carbon and nitrogen. The nitrogen and carbon (methane) ratio may be adjusted.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a gate electrode material as taught by Joo in applicant's admitted prior art to lower device resistance. It is reasonable that the gate electrode has been exposed to temperatures greater than 700°C since the source/drain regions require activation at such temperatures.

Claims 1-3, 6-13, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art and Choi – US 6,340,827.

Applicant's admitted prior art on pages 1-2 of the specification discloses substantially the claimed invention by forming a gate electrode material over a gate dielectric material which are patterned, and forming current electrodes (source/drain regions which may be doped either p or n type) laterally adjacent the gate dielectric. The admitted prior art does not disclose depositing the gate electrode material comprising a transition metal and elements consisting of (boron or carbon) and nitrogen. Choi (col. 3, line 13 to col. 4, line 51) teaches to form a gate electrode material, which comprises the claimed materials. Note Choi states layer 100 or 310 can comprise two or more layers in any combination.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a gate electrode material as taught by Choi in applicant's admitted prior art to lower device resistance. It is reasonable that the gate electrode has been exposed to temperatures greater than 700°C since the source/drain regions require activation at such temperatures.

Claims 19-21, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikoshiba and Choi.

Mikoshiba is applied as above and does not disclose the gate electrode comprising nitrogen, nor exposing to a temperature greater than 700°C. Choi (col. 3, line 13 to col. 4, line 51) teaches to form a gate electrode material with boron, carbon, and nitrogen.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a gate electrode material containing nitrogen as taught by Choi in Mikoshiba's process for diffusion control. It is reasonable that the gate electrode has been exposed to temperatures greater than 700°C since the source/drain regions require activation at such temperatures.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Maiti - US 6,027,961 describes metal gates and work functions.

Art Unit: 2813

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chandra Chaudhari whose telephone number is 571-272-1688. The examiner can normally be reached on Mon - Fri (9:00-5:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chandra Chaudhari

Primary Examiner

Art Unit 2813

*C. Chaudhari*  
Chandra Chaudhari

February 4, 2005